

SECTION 6.5

AEROSOL RESIDENTIAL PESTICIDES

(Updated June 1989)

EMISSION INVENTORY SOURCE CATEGORY

Solvent Evaporation /Aerosol Residential Pesticides

EMISSION INVENTORY CODES (CES CODES)AND DESCRIPTION

530-534-5700-0000 (83238) Aerosol Residential Pesticides - Propellants

530-536-5700-0000 (83246) Aerosol Residential Pesticides - Ingredients

METHODS AND SOURCES

This category is an inventory of the total organic gas (TOG) emissions from the use of aerosol consumer product pesticides. The emissions are inventoried in two subcategories; **Propellants** and **Other Organic Ingredients**. These products may be used in residential, institutional, and commercial establishments. It is assumed that consumer product pesticides are applied by non-licensed pesticide control operators and that both the active and inert ingredients may contain volatile organic compounds. The emissions from non-aerosol consumer product pesticides will be inventoried under CES 83253 when data are available to estimate emissions.

Emissions from propellant and other organic ingredients in aerosol consumer product pesticides were calculated for 1983 using national production data, based on the following methodology. A nationwide total for the number of aerosol insect spray product units filled in 1983 was reported by the Chemical Specialties Manufacturers Association (CSMA) ¹ based on a survey of its member companies. CSMA adjusted the reported responses to take into account responses not received. These adjusted "estimated totals" were taken to best represent 1983 U.S. totals. It was assumed that the number of units filled or distributed was equal to the number of units sold and that usage was proportional to population. The California portion of the nationwide estimate of aerosol usage was based on population distribution, with the California population estimated to be 10.8 percent of the U.S. population in 1983. ^{2,3} Emissions from aerosol consumer product pesticides were grown to 1987 using CSMA national data cited in Chemical and Engineering News.⁴

Data published in 1981 by the Western Aerosol Information Bureau (WAIB) ⁵ were used to determine the average size of a product unit for each subcategory and the percent by weight of each product unit that is propellant volatile organic compound (VOC) and other ingredient VOC. Since the WAIB ⁵ is the only available source of data on fractions of propellant vs. other organic ingredients in these products, ARB staff has assumed that WAIB VOC fractions can be used to estimate total organic gas (TOG) emissions. For these aerosol products, the difference between volatile organic compounds and the compounds comprising total organic gases is assumed to be negligible.

The amount of propellant VOC contained in a given aerosol product was calculated by multiplying the average product unit weight by the number of units filled and by the average concentration (weight percent) of propellant VOC in the product. Most of these propellants are non-synthetic LPGs such as propane, butane and isobutane. Synthetic propellants such as chlorofluorocarbons were not used significantly as propellants in 1983 except in small quantities in pharmaceuticals.

The amount of VOC in the other ingredients was calculated by multiplying the average product unit weight by the number of units filled and by the average concentration (weight percent) of other ingredient VOC in the product. A sample calculation follows.

Sample Calculation for Aerosol Residual Insecticides:

$$\begin{aligned}
 \text{(A) CSMA estimated total units for residual insecticides in U.S.} &= \frac{\text{CSMA estimated total units for Insect Sprays}}{\text{CSMA reported total units for Insect Sprays}} \times \text{CSMA reported total units for residual insecticides} \\
 &= \frac{180,051,000 \text{ units}}{177,051,000 \text{ units}} \times 55,775,000 \text{ units} \\
 &= 56,720,000 \text{ units in U.S.}
 \end{aligned}$$

(B) Tons of Product used in Calif. in 1983

$$\begin{aligned}
 &= (\text{CSMA estimated total units in U.S.}) (\text{Ratio of 1983 CA population to U.S. population}) (\text{Avg. oz/unit}) (1 \text{ lbs}/16 \text{ oz}) (1 \text{ ton}/2,000 \text{ lbs}) \\
 &= (56,720,000 \text{ units}) (0.108) (15 \text{ oz/unit}) (1 \text{ lbs}/16 \text{ oz}) (1 \text{ ton}/2,000 \text{ lbs}) \\
 &= 2,872 \text{ tons of product used in 1983}
 \end{aligned}$$

(C) Tons propellant VOC

= (Tons product used) (WAIB % propellant VOC/100)

= (2,872 tons) (0.10)

= 287 tons propellant VOC

(D) Tons other ingredient VOC

= (Tons product used) (WAIB % other ingredient VOC/100)

= (2,872 tons) (0.45)

= 1,292 tons other ingredient VOC

Table I contains usage estimates for 1983 calculated for the propellant and other organic ingredients in space and residual insecticides. It was assumed that all of the propellant and other organic ingredients contained in the can are eventually used and emitted into the atmosphere. Usage estimates of tons of propellant and other organic ingredients used in these aerosol products are assumed to be equivalent to tons of total organic gas (TOG) emitted. As previously mentioned, these estimates are grown to 1987 using CSMA national data cited in Chemical and Engineering News. ⁴

The notes for Table I further explain the basic methodology used for estimating usage and emissions.

Summary of Solvent Usage and Countywide Emissions

The statewide process rate and emissions are apportioned to the counties based on relative population in 1987. The countywide process rates and total organic gas emissions (tons/year) for aerosol consumer product pesticides are reported in Tables II and III.

Total organic gas emissions in California from aerosol consumer product pesticides are estimated to be 1,357 tons of propellants and 3,754 tons of other organic ingredients in 1987.

ASSUMPTIONS

1. The 1983 CSMA national data on number of aerosol product units filled are representative of U.S. totals.

2. The 1981 WAIB data on average product size and on concentration of propellant and other organic ingredient VOCs in the aerosol products are representative of 1983 values and can be used to estimate emissions for total organic gases.
3. Applications of aerosol consumer product pesticides are performed by non-licensed pesticide control operators, mainly in households and gardens.
4. All of the aerosol units filled or distributed were used.
5. All of the propellant and other organic ingredients in the can are emitted eventually into the outdoor atmosphere.
6. The propellants used are mostly non-synthetic; use of synthetic propellants is negligible.
7. Nationwide usage can be disaggregated statewide using population proportioning.
8. 1983 usage estimates may be updated to 1987 on the basis of national production data.
9. Emission estimates can be disaggregated to counties based on population proportioning.

COMMENTS AND RECOMMENDATIONS

Surveys should be taken to obtain more accurate total, spatial, and temporal usage data for California. Surveys should be conducted to separate commercial and institutional usage of aerosol consumer product pesticides from uses in homes and gardens. For products that are used indoors, more study is needed to determine what proportion of the organic gases are ultimately emitted into the outdoor air.

CHANGES IN METHODOLOGY

There are no changes in methodology.

DIFFERENCES BETWEEN 1987 AND 1983 EMISSION ESTIMATES

The 1987 emission estimates are larger than the 1983 estimates due to increased production.

TEMPORAL ACTIVITY

The annual activity is highest in the summer and lowest in the winter. The daily activity occurs during daylight hours and the weekly activity is uniform seven days a week.

REFERENCES

1. Chemical Specialties Manufacturers Association, Inc., Pressurized Products Survey United States 1983, (1984).
2. U.S. Department of Commerce, Bureau of the Census, Current Population Reports - Population Estimates and Projections, Series P-25, No. 1025, (April 1988).
3. California Department of Finance, Population Research Unit, "Projected Total Population for California by Race/Ethnicity, July 1, 1970 to July 1, 2020", Report 88 P-4, (February 1988).
4. "Production by the U.S. Chemical Industry", Chemical and Engineering News, 66(25):44, (June 20, 1988).
5. Western Aerosol Information Bureau, VOC Emissions Distribution From Aerosol Spray Products During 1981, (1981).

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TABLE I

Estimates of Statewide Organic Ingredient Usage
for Aerosol Consumer Product Pesticides

Estimates Calculated by ARB Only - No District Estimates

Product Category ⁽¹⁾	Tons per Year			
	1983 Usage ⁽²⁾		1987 Usage ⁽³⁾	
	Propellant	Solvent	Propellant	Solvent
Insect Sprays				
1. Space Insecticides	999	2,264	1,054	2,390
2. Residual Insecticides (personal and surface repellants, moth proofers, etc, excluding pet products)	287	1,292	303	1,364
3. Other Consumer Pesticides	No known products		-----	-----
Subtotal	1,286	3,556	1,357	3,754

Notes:

- (1) These product categories are based on CSMA categories. The level of detail reflected in the categories in this table exceeds that in the actual EIC codes in the California Emission Inventory Development and Reporting System (CEIDARS) and is provided for information only.
- (2) The number of aerosol units filled (assumed equal to number used) is taken from the adjusted "estimated totals" reported in the 1983 CSMA pressurized products survey. Since estimated totals were only available for categories and not the subcategories, the subcategory category titles were derived as follows:

$$\text{Estimated total for subcategory} = \frac{\text{Estimated total for category}}{\text{Reported total for category}} \times \text{Reported total for subcategory}$$

WAIB data from 1981 are used to determine the average size of a unit for each subcategory and for the percent propellant VOC and percent solvent VOC. Where the subcategories listed by WAIB are more disaggregated than those listed by CSMA, a

weighted average is calculated for size of unit, percent propellant VOC, and percent solvent VOC based on the relative number of units reported for the subcategories in the 1981 WAIB table.

- (3) The 1983 usage estimates are updated to 1987 on the basis of CSMA national data cited in Chemical and Engineering News. This publication shows that the production of insect sprays grew from 180 million units in 1983 to 190 million units in 1987. To derive 1987 usage estimates, the 1983 usage estimates are multiplied by the ratio 190/180.

Table II
1987 Area Source Emissions
Activity: Domestic
Process: Pesticide Application
Entrainment: Solvent - Evap
Dimn: Aerosol - Propellant Consumer Products
CES: 83238
Process Rate Unit: Tons Sprayed

AB	County	Process Rate	TOG Emis. (Tons / Year)	CO Emis. (Tons / Year)	NOX Emis. (Tons / Year)	SOX Emis. (Tons / Year)	PM Emis. (Tons / Year)
GBV	ALPINE	0	0.06	0.00	0.00	0.00	0.00
	INYO	1	0.88	0.00	0.00	0.00	0.00
	MONO	0	0.45	0.00	0.00	0.00	0.00
LC	LAKE	2	2.49	0.00	0.00	0.00	0.00
LT	EL DORADO	2	1.53	0.00	0.00	0.00	0.00
MC	PLACER	1	0.53	0.00	0.00	0.00	0.00
	AMADOR	1	1.25	0.00	0.00	0.00	0.00
	CALAVERAS	1	1.45	0.00	0.00	0.00	0.00
	EL DORADO	4	4.02	0.00	0.00	0.00	0.00
	MARIPOSA	1	0.69	0.00	0.00	0.00	0.00
	NEVADA	4	3.62	0.00	0.00	0.00	0.00
	PLACER	1	0.78	0.00	0.00	0.00	0.00
	PLUMAS	1	0.97	0.00	0.00	0.00	0.00
	SIERRA	0	0.17	0.00	0.00	0.00	0.00
	TUOLUMNE	2	2.20	0.00	0.00	0.00	0.00
NC	DEL NORTE	1	0.95	0.00	0.00	0.00	0.00
	HUMBOLDT	6	5.58	0.00	0.00	0.00	0.00
	MENDOCINO	4	3.68	0.00	0.00	0.00	0.00
	SONOMA	3	2.84	0.00	0.00	0.00	0.00
	TRINITY	1	0.67	0.00	0.00	0.00	0.00
NCC	MONTEREY	17	16.83	0.00	0.00	0.00	0.00
	SAN BENITO	2	1.63	0.00	0.00	0.00	0.00
	SANTA CRUZ	11	10.93	0.00	0.00	0.00	0.00
NEP	LASSEN	1	1.30	0.00	0.00	0.00	0.00
	MODOC	0	0.46	0.00	0.00	0.00	0.00
	SISKIYOU	2	2.10	0.00	0.00	0.00	0.00
SC	LOS ANGELES	409	409.10	0.00	0.00	0.00	0.00
	ORANGE	109	108.70	0.00	0.00	0.00	0.00
	RIVERSIDE	33	33.10	0.00	0.00	0.00	0.00
	SAN BERNARDINO	48	47.50	0.00	0.00	0.00	0.00
SCC	SAN LUIS OBISPO	10	9.90	0.00	0.00	0.00	0.00
	SANTA BARBARA	17	16.82	0.00	0.00	0.00	0.00
	VENTURA	31	30.81	0.00	0.00	0.00	0.00
SD	SAN DIEGO	112	112.30	0.00	0.00	0.00	0.00
SED	IMPERIAL	5	5.36	0.00	0.00	0.00	0.00
	KERN	3	3.41	0.00	0.00	0.00	0.00
	LOS ANGELES	7	7.10	0.00	0.00	0.00	0.00
	RIVERSIDE	12	11.80	0.00	0.00	0.00	0.00
SF	SAN BERNARDINO	11	11.40	0.00	0.00	0.00	0.00
	ALAMEDA	60	60.22	0.00	0.00	0.00	0.00
	CONTRA COSTA	36	36.13	0.00	0.00	0.00	0.00
	MARIN	11	11.31	0.00	0.00	0.00	0.00
	NAPA	5	5.11	0.00	0.00	0.00	0.00
	SAN FRANCISCO	36	36.13	0.00	0.00	0.00	0.00
	SAN MATEO	30	30.29	0.00	0.00	0.00	0.00
	SANTA CLARA	70	70.08	0.00	0.00	0.00	0.00
	SOLANO	11	10.95	0.00	0.00	0.00	0.00
	SONOMA	15	14.96	0.00	0.00	0.00	0.00
SV	FRESNO	29	29.28	0.00	0.00	0.00	0.00
	KERN	21	21.36	0.00	0.00	0.00	0.00
	KINGS	4	4.31	0.00	0.00	0.00	0.00
	MADERA	4	3.93	0.00	0.00	0.00	0.00
	MERCED	8	8.15	0.00	0.00	0.00	0.00
	SAN JOAQUIN	22	21.80	0.00	0.00	0.00	0.00
	STANISLAUS	16	16.03	0.00	0.00	0.00	0.00
	TULARE	14	14.30	0.00	0.00	0.00	0.00
	BUTTE	8	8.30	0.00	0.00	0.00	0.00
	COLUSA	1	0.73	0.00	0.00	0.00	0.00
SV	GLENN	1	1.13	0.00	0.00	0.00	0.00
	PLACER	6	5.97	0.00	0.00	0.00	0.00
	SACRAMENTO	46	46.47	0.00	0.00	0.00	0.00
	SHASTA	7	6.60	0.00	0.00	0.00	0.00
	SOLANO	4	4.10	0.00	0.00	0.00	0.00
	SUTTER	3	2.96	0.00	0.00	0.00	0.00
	TEHAMA	2	2.25	0.00	0.00	0.00	0.00
	YOLO	6	6.33	0.00	0.00	0.00	0.00
	YUBA	3	2.73	0.00	0.00	0.00	0.00
TOTAL		1355	1357.27	0.00	0.00	0.00	0.00

Fraction of Reactive Organic Gases (FROG): 1.0000
 (Reactive Organic Gases (ROG) Emissions = TOG X FROG)
 Fraction of PM10 (FRPM10): .9600
 (PM10 Emissions = PM X FRPM10)

Table III
1987 Area Source Emissions
Activity: Domestic
Process: Pesticide Application
Entrainment: Solvent - Evap
Dimn: Aerosol Products - Solvents Consumer Products
CES: 83246

Process Rate Unit: Tons Sprayed

AB	County	Process Rate	TOG Emis. (Tons / Year)	CO Emis. (Tons / Year)	NOX Emis. (Tons / Year)	SOX Emis. (Tons / Year)	PM Emis. (Tons / Year)
GBV	ALPINE	0	0.16	0.00	0.00	0.00	0.00
	INYO	2	2.44	0.00	0.00	0.00	0.00
	MONO	1	1.25	0.00	0.00	0.00	0.00
LC	LAKE	7	6.89	0.00	0.00	0.00	0.00
LT	EL DORADO	4	4.24	0.00	0.00	0.00	0.00
	PLACER	1	1.48	0.00	0.00	0.00	0.00
MC	AMADOR	3	3.45	0.00	0.00	0.00	0.00
	CALAVERAS	4	4.02	0.00	0.00	0.00	0.00
	EL DORADO	11	11.12	0.00	0.00	0.00	0.00
	MARIPOSA	2	1.90	0.00	0.00	0.00	0.00
	NEVADA	10	10.02	0.00	0.00	0.00	0.00
	PLACER	2	2.15	0.00	0.00	0.00	0.00
	PLUMAS	3	2.69	0.00	0.00	0.00	0.00
	SIERRA	0	0.46	0.00	0.00	0.00	0.00
	TUOLUMNE	6	6.08	0.00	0.00	0.00	0.00
	DEL NORTE	3	2.63	0.00	0.00	0.00	0.00
NC	HUMBOLDT	15	15.43	0.00	0.00	0.00	0.00
	MENDOCINO	10	10.18	0.00	0.00	0.00	0.00
	SONOMA	8	7.86	0.00	0.00	0.00	0.00
	TRINITY	2	1.85	0.00	0.00	0.00	0.00
NCC	MONTEREY	47	46.56	0.00	0.00	0.00	0.00
	SAN BENITO	5	4.51	0.00	0.00	0.00	0.00
	SANTA CRUZ	30	30.25	0.00	0.00	0.00	0.00
NEP	LASSEN	4	3.60	0.00	0.00	0.00	0.00
	MODOC	1	1.26	0.00	0.00	0.00	0.00
	SISKIYOU	6	5.82	0.00	0.00	0.00	0.00
SC	LOS ANGELES	1132	1131.80	0.00	0.00	0.00	0.00
	ORANGE	301	300.80	0.00	0.00	0.00	0.00
	RIVERSIDE	92	91.60	0.00	0.00	0.00	0.00
	SAN BERNARDINO	131	131.50	0.00	0.00	0.00	0.00
SCC	SAN LUIS OBISPO	27	27.40	0.00	0.00	0.00	0.00
	SANTA BARBARA	47	46.53	0.00	0.00	0.00	0.00
	VENTURA	85	85.24	0.00	0.00	0.00	0.00
SD	SAN DIEGO	311	310.50	0.00	0.00	0.00	0.00
SED	IMPERIAL	15	14.82	0.00	0.00	0.00	0.00
	KERN	9	9.43	0.00	0.00	0.00	0.00
	LOS ANGELES	20	19.60	0.00	0.00	0.00	0.00
	RIVERSIDE	33	32.60	0.00	0.00	0.00	0.00
SF	SAN BERNARDINO	32	31.60	0.00	0.00	0.00	0.00
	ALAMEDA	166	166.07	0.00	0.00	0.00	0.00
	CONTRA COSTA	100	100.01	0.00	0.00	0.00	0.00
	MARIN	31	31.02	0.00	0.00	0.00	0.00
	NAPA	14	14.23	0.00	0.00	0.00	0.00
	SAN FRANCISCO	99	99.64	0.00	0.00	0.00	0.00
	SAN MATEO	84	83.95	0.00	0.00	0.00	0.00
	SANTA CLARA	194	193.81	0.00	0.00	0.00	0.00
	SOLANO	30	29.93	0.00	0.00	0.00	0.00
	SONOMA	41	41.24	0.00	0.00	0.00	0.00
	FRESNO	81	80.99	0.00	0.00	0.00	0.00
	KERN	59	59.08	0.00	0.00	0.00	0.00
SV	KINGS	12	11.93	0.00	0.00	0.00	0.00
	MADERA	11	10.87	0.00	0.00	0.00	0.00
	MERCED	23	22.55	0.00	0.00	0.00	0.00
	SAN JOAQUIN	60	60.29	0.00	0.00	0.00	0.00
	STANISLAUS	44	44.35	0.00	0.00	0.00	0.00
	TULARE	40	39.56	0.00	0.00	0.00	0.00
	BUTTE	23	22.97	0.00	0.00	0.00	0.00
	COLUSA	2	2.01	0.00	0.00	0.00	0.00
	GLENN	3	3.12	0.00	0.00	0.00	0.00
	PLACER	17	16.51	0.00	0.00	0.00	0.00
	SACRAMENTO	129	128.57	0.00	0.00	0.00	0.00
	SHASTA	18	18.40	0.00	0.00	0.00	0.00
YOLA	SOLANO	11	11.50	0.00	0.00	0.00	0.00
	SUTTER	8	8.18	0.00	0.00	0.00	0.00
	TEHAMA	6	6.23	0.00	0.00	0.00	0.00
	YOLO	18	17.51	0.00	0.00	0.00	0.00
	YUBA	8	7.56	0.00	0.00	0.00	0.00
TOTAL		3754	3753.80	0.00	0.00	0.00	0.00

Fraction of Reactive Organic Gases (FROG): 1.0000
 (Reactive Organic Gases (ROG) Emissions = TOG X FROG)
 Fraction of PM10 (FRPM10): .9600
 (PM10 Emissions = PM X FRPM10)